

## **8. ANALYSIS OF ENVIRONMENTAL UNCERTAINTIES**

### **8.1 ENVIRONMENTAL ISSUES**

In the process of power generation technology selection, the decision-maker is evaluating systems that will enable utilities to meet stringent environmental requirements while providing competitive electricity prices. The technologies must produce significantly lower emissions of acid rain gases, greenhouse gases, and air toxics species than the present generation of coal-fueled power plants. Additionally, the project must be environmentally sound such that a permit can be obtained before the project is considered for financing. The financial community looks at the satisfaction of regulatory and permit issues as a pre-requisite to any commitment. The permit must exist or be obtainable before the financial community will commit funds. Specifically, the financial community will not accept any permitting or environmental risk. This means that the need to develop and obtain the environmental permits is the responsibility of the ultimate owner or the developer. In addition, from the lender's perspective, there is no "extra credit" given for developing a design that goes beyond the environmental and regulatory requirements.

At a time when the utility business is becoming more deregulated, the technology required to produce electric power has to satisfy more environmental regulatory requirements. New or modified facilities must be developed to comply with a full range of environmental regulations. The significant regulations and environmental issues include:

- National Environmental Policy Act of 1969 (NEPA)
- Clean Air Act Amendments of 1990 (CAAA)
- New Source Performance Standards (NSPS)
- National Ambient Air Quality Standards (NAAQS)
- Prevention of Significant Deterioration (PSD)
- Greenhouse Gases Reduction
- Emissions Allowances and Trading

- Hazardous Air Pollutants
- Water Discharge
- Solid Waste Disposal
- Externalities

The CAAA requirements are the most extensive, and the technology needed to address these requirements offers an opportunity for CCTs to achieve a competitive advantage. The advantage to an existing generator is that the emission reductions required of existing plants would be achieved by repowering with a CCT rather than installing additional emission controls to the source. This assumption is realistic in that the CCT will meet the most stringent emission limitation expected.

A review of both existing environmental regulations and potential future environmental concerns, which may or may not impact the selection of technology, is valuable to the decision-making process. The following highlights some of the key issues.

**The National Environmental Policy Act (NEPA)** - NEPA of 1969 was approved into law on January 1, 1970. This Act established a national policy to promote efforts that will prevent or eliminate damage to the environment. The law required, as a part of a proposal for activities that could have a significant impact on the quality of the human environment, the submission of an Environmental Impact Statement (EIS). The EIS identifies environmental impacts that can result from a project and then provides an approach and alternatives that may be used to mitigate the impacts. The specific requirements for the EIS have evolved and will continue to evolve. However, for CCT projects, the most significant requirements include emission streams, effluent streams, and waste streams associated with air, water, and solid waste. The EIS will identify the quantity, composition, and frequency of discharges. The evaluation of discharges is essential to ensure the project meets discharge limitations.

**Clean Air Act Amendments of 1990 (CAAA)** - CAAA was signed into law in November of 1990 with a goal to reduce pollution from gaseous emissions by 56 billion pounds a year. The control of pollutants that can contribute to acid rain is subject to Title IV of the CAAA. These

regulations include a two-phase, market-based approach to reduce SO<sub>2</sub> emissions from power plants and provides for the requirement to have an allowance trading system. Reductions of oxides of nitrogen will also be achieved, but through performance standards set by the Environmental Protection Agency (EPA). Title III of the CAAA identifies a “major polluter” as a source that will emit more than 10 tons per year of any one of 189 listed hazardous pollutants or more than 25 tons per year of any combination of hazardous air pollutants. Other requirements of the CAAA cover non-attainment areas, permitting, motor vehicles, and stratospheric ozone depletion.

**The Energy Policy Act of 1992 (EPAct)** - EPAct was signed into law in October of 1992. Under Title XVI, Global Climate Change is addressed. Among the provisions, Title XVI calls for DOE to establish a voluntary reporting system for participants to submit information on their greenhouse gas emissions. On October 19, 1993, the Climate Change Action Plan, which described the actions that would be taken to reduce greenhouse gas emissions, was released by the President and Vice President. The Plan describes nearly 50 new and expanded initiatives that would reduce emissions. Included in those initiatives were the use of CCTs.

**New Source Performance Standards (NSPS)** - The EPA has issued a series of standards that address a number of basic industrial categories. NSPS reflect the maximum degree of emission control that can be achieved by an industry through direct emission control, operation, and other available methods. NSPS are available for the various fuel sources and are used as a part of the permitting process. NSPS are applicable to the following combustion sources:

- Fossil fuel fired steam generators
- Electricity utility steam generating units
- Industrial - commercial - institutional steam generating units
- Incinerators
- Municipal waste combustors
- Sewage treatment plants

- Gas turbines

**National Ambient Air Quality Standards (NAAQS)** - The Clean Air Act directs EPA to identify and set national ambient air quality standards for pollutants that cause adverse effects to public health and the environment. EPA has set national air quality standards for six common air pollutants: particulate matter (measured as PM<sub>10</sub> and PM<sub>2.5</sub>), sulfur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), carbon monoxide (CO), ground-level ozone (O<sub>3</sub>) [smog], and lead (Pb). For each of these pollutants, EPA has set health-based or “primary” standards to protect public health, and welfare-based or “secondary” standards to protect the environment (crops, vegetation, wildlife, buildings and national monuments, visibility, etc.). Additional requirements will be placed on facilities based on whether the facility will be located in an area that is meeting the ambient air quality standards. If the NAAQS are being met in an area of a proposed facility, the facility will be subject to the requirements of the attainment area (i.e., prevention of significant deterioration of air quality). If requirements are not being met, non-attainment area requirements will be applicable. In non-attainment areas, the control equipment should be designed to achieve the lowest achievable emission rate (LAER), which is the most stringent of either any State’s Implementation Plan emission rate or any demonstrated technology but in no case less stringent than NSPS. The non-attainment area requirements also specify that the emissions from the new source be more than offset by a reduction in emissions from existing sources in the area.

**Prevention of Significant Deterioration (PSD)** - The PSD requirements are applicable to major modifications or new major stationary sources being located in areas that are meeting NAAQS. The PSD requirements are developed around the concept of installing the best available control technology (BACT). By definition, the CCTs should qualify as BACT, which is the maximum degree for emission reduction determined on a case-by-case basis for new sources in clean air areas with cost, energy, and technical feasibility taken into account, but in no case is BACT less stringent than NSPS. The PSD requirements also include air quality dispersion modeling to estimate compliance with PSD increments and NAAQS. Preconstruction monitoring (both ambient air pollutants and meteorology) may be required for comparing existing ambient air quality to NAAQS and for dispersion modeling. An analysis of impairment to visibility, soils, and vegetation that would occur as a result of the source, and the air quality impacts of projected

general commercial, residential, industrial, and other growth associated with the source is also required.

**Environmental Externalities** - The costs to society because of increased health care, depleted resources, and a general reduction in quality of life are environmental externalities. However, the consideration of environmental externalities has not yet been a major influence in the selection of technology for electrical power generation. The categories of environmental externalities range from measured impacts on crops, fish, recreational opportunities, and visual aesthetics. The trend away from reflecting environmental costs in utility decisions is occurring due to the ratepayer and competitive pressure to reduce the cost of power.

#### **8.1.1 Future Environmental Concerns**

At the present time, the uncertainties of future pollution control plans discussed below cause concerns that will have to be addressed if they become an EPA standard. In fact, the more stringent standards will likely affect existing sources as well as future sources. The future sources will have to use the emission offsets from the existing sources against new sources. There has not been any indication of the direction that EPA is heading, and it is not possible to anticipate what the future requirements may be, or the effect. Nevertheless, the future emissions from a new or repowered plant with a CCT will be less than the emissions from the existing plant.

Table 8-1 provides a brief implementation schedule for some of the CAAA Titles.

**Ozone Non-Attainment** - Title I of the CAAA addresses the issue of non-attainment, that is, those areas that are not meeting ambient air quality standards. The area of concern in this regard is the ozone non-attainment area. Within ozone non-attainment areas, the concern is that NO<sub>x</sub> emissions are being considered as precursors to ozone generation, and further control of NO<sub>x</sub> emissions may be forthcoming. In the Northeast Ozone Transport Region, a potential future requirement limiting NO<sub>x</sub> emission rates to 0.2 lb/MMBtu, or lower, may be imposed in order to meet ozone standards in the region.

**Table 8-1**  
**CAAA of 1990 SUMMARY SCHEDULE**

Title	Phase	Poll	Description	Sources Affected	Regs Due	Implement Date
I			OZONE NON-ATTAINMENT (NO <sub>x</sub> ) (OTR (4) sources only)			
	1	NO <sub>x</sub>	RACT	All Major Sources (1)	1993	5/31/95
	2	NO <sub>x</sub>	Meet ambient air quality standards (2)	>250 MMBtu/h heat input & >15 MW	1997	5/1/99
	3	NO <sub>x</sub>	Meet ambient air quality standards (2)	>250 MMBtu/h heat input & >15 MW	2001	5/1/03
III			HAZARDOUS AIR POLLUTANTS (HAPs)			
		HAPs	Draft Report to Congress on Utilities HAP emissions due 4/96. Final Report to Congress due 12/96.	Utility Boilers, if EPA decides that HAP emissions pose a risk. Proposed Air Toxic Regulations	11/15/98	
		HAPs	Maximum Achievable Control Technology (MACT)	Utility Boilers, if EPA decides that HAP emissions pose a risk. Final Air Toxic Regulations	11/15/2000	2003
IV			ACID DEPOSITION			
	1	NO <sub>x</sub>	Low-NO <sub>x</sub> Burner Technology (3)	Group 1 175 tangential fired and dry bottom/wall-fired boilers (3)		1/1/96
	1	SO <sub>2</sub>	Allocation System	Units >100 MW and emitting >2.5 lb/MMBtu		1/1/95
	2	NO <sub>x</sub>	Best system in cost comparable to Phase 1 Low-NO <sub>x</sub> Burner (3)	Group 2 boilers >25 tons NO <sub>x</sub> /year, 2000 Units (3)	1/1/97	1/1/00
	2	SO <sub>2</sub>	Allocation System	Units >25 MW		1/1/00
V			PERMITS	Operating Permits for All Sources		11/95

Notes:

- (1) In Pennsylvania facilities emitting 100 tons or more of NO<sub>x</sub>/year and in New Jersey facilities emitting 25 tons or more of NO<sub>x</sub>/year.
- (2) Applicable in the 5-month period (May-Sept) with RACT year around.
- (3) Affects utilities outside the Ozone Transport Region (OTR) as Title I is more stringent than Title IV for OTR affected utilities.
- (4) Northeast OTR comprises northern Virginia through Maine including Washington, D.C. In order for the OTR to meet ambient air quality standards, the Ozone Transport Assessment Group is considering expanding the area covered to those upwind states bordering the Mississippi River eastward and Texas.

**Ozone NAAQS** - EPA is phasing out and replacing the previous 1-hour primary ozone standard with a new 8-hour standard to protect against longer exposure periods. EPA is setting the standard at 0.08 parts per million (ppm). EPA will designate areas as non-attainment for ozone by the year 2000 (using the most recently available three years of air quality data at that time). Areas will have up to three years (or until 2003) to develop and submit state implementation plans (SIPs) to provide for attainment of the new standard. The new standards will not require local emission controls until 2004, with no compliance determinations until 2007. The Clean Air Act allows up to 10 years from the date of designation for areas to attain the revised standards with the possibility of two one-year extensions.

**Ozone Transport Assessment Group (OTAG)** - Because ozone is a pollutant that travels great distances, it is increasingly clear that it must be addressed as a regional problem. For the past two years the EPA has been working with the 37 most eastern states through the OTAG in the belief that reducing interstate pollution will help all areas in the OTAG region attain the NAAQS. A regional approach can reduce compliance costs and allow many areas to avoid most traditional non-attainment planning requirements. The OTAG completed its work in June 1997 and forwarded recommendations to the EPA. Based on these recommendations, the EPA will propose a rule requiring states in the OTAG region that are significantly contributing to non-attainment or interfering with maintenance of attainment in downwind states to submit SIPs to reduce their interstate pollution. The EPA plans to issue the final rule by September 1998.

**PM<sub>2.5</sub> NAAQS** - EPA is making more stringent the current particulate standard from PM<sub>10</sub> down to PM<sub>2.5</sub> and smaller. EPA revised the PM standards by adding a new annual PM<sub>2.5</sub> standard set at 15 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ) and a new 24-hour PM<sub>2.5</sub> standard set at 65  $\mu\text{g}/\text{m}^3$ . The EPA will make designation determinations (i.e., attainment, non-attainment, or unclassifiable) within two to three years of revising a standard. A comprehensive monitoring network will be required to determine ambient PM<sub>2.5</sub> particle concentrations across the country. Monitoring data will be available from the earliest monitors by the spring of 2001, and three years of data will be available from all monitors in 2004. EPA will make the first determinations about which areas should be designated non-attainment status by 2002. States will have three years from the date of being designated non-attainment (or until between 2005 and 2008) to develop pollution control

plans and submit them to EPA showing how they will meet the new standards. Areas will then have up to 10 years from their designation as non-attainment to attain the PM<sub>2.5</sub> standards, with the possibility of two one-year extensions.

**SO<sub>2</sub> NAAQS** - In January 1997, EPA proposed a new program to address the potential health risks posed to asthmatics by short-term peak levels of sulfur dioxide in localized situations. If implemented, this standard could affect sources with a potential to produce high concentrations of short-term bursts of SO<sub>2</sub> emissions.

**Haze** - The EPA proposed regional haze regulations to address visibility impairment. The proposed regulations will protect specific areas of concern, known as “Class I” areas. The Clean Air Act defines mandatory Class I Federal areas as certain national parks (over 6,000 acres), wilderness areas (over 5,000 acres), national memorial parks (over 5,000 acres), and international parks. There are 156 of these areas protected under the existing visibility protection program. The proposed regional haze regulations apply to all states, including those states that do not have any Class I areas. State and local air quality agencies will implement the proposed regional haze program through revisions to their SIPs. The states will make decisions about specific emission management strategies.

**Hazardous Air Pollutants** - Title III of the CAAA covers the emissions of hazardous air pollutants (HAPs) from stationary sources. This has the potential of requiring power plants to control emissions of HAPs and to perform risk assessments of the most exposed individual if required by EPA. There is a study by the Electric Power Research Institute (EPRI) that indicates the emissions of HAPs from power plants are quite small -- in fact, just over half the values previously estimated by EPA. The EPA is required under the CAAA to perform two studies on power plant HAP emissions; one regarding the emissions of mercury from power plants, and the other on all other HAP emissions from utility sources. The interim report on HAPs, including mercury, was sent to Congress in October 1996; the final report was issued in early 1998. The final report recommended further study on HAPs.

**Acid Deposition** - Title IV relates to acid deposition. Phase I SO<sub>2</sub> emission requirements are being met primarily by fuel switching and/or blending, with some utilities opting for flue gas



desulfurization (FGD) systems to take advantage of bonus allowances for early compliance with the Phase II requirements. The indications are that Phase II requirements for the utilities will be a test of the use of the allowance system. Utilities are expected to be purchasing excess allowances during Phase I and saving them for use in Phase II. Many utilities will be able to postpone making a decision on the method to be used to comply with the allowance program, whether it is the further use of fuel switching, or the installation of FGD scrubbers (which are also being demonstrated in the CCT program), or repowering existing sources with a CCT system with its inherently low SO<sub>2</sub> emission rate. The benefits of CCT are seen in the emission projections that are lower than emission rates projected by competitive technologies. Phase II NO<sub>x</sub> emission regulations are established for the various boiler types with the emission limits based on combustion controls, coal or natural gas reburning, or selective catalytic reduction.

**NO<sub>x</sub> NSPS** - The EPA proposed revisions to the Standards of Performance for Nitrogen Oxide emissions from new fossil-fuel fired steam generating units. The proposed emission limit is that after July 9, 1997 no affected unit shall be constructed, modified, or reconstructed such that the discharge of any gases contain nitrogen oxides in excess of 170 nanograms per joule (1.35 pounds per megawatt-hour) net energy output. < Definitions: Net output means the net useful work performed by the steam generated, taking into account the energy requirements for auxiliaries and emission controls. For units generating only electricity, the net useful work performed is the net electrical output (i.e., net busbar power leaving the plant) from the turbine generator set. >

**Greenhouse Gases** - International agreements have targeted CO<sub>2</sub> for reduction to pre-1990 levels. The overall effect of these international agreements is that the use of fossil fuels must be made more efficient than the existing operations. The U.S. policy on climate change calls for signing a legally binding treaty to reduce greenhouse gas emissions. A Senate resolution (S.Res. 98) states that the Senate will not approve a treaty that does not set identical emissions levels and compliance timetables for all parties. The resolution endorses the scientific consensus on climate change, and, while it throws a spotlight on the issue of developing countries, it still allows the United States negotiating flexibility.

**Water** - Water-related requirements such as water usage may be a significant issue that impacts the environmental permitting. For example, the concept of zero discharge may impact the handling of the process water. The trend in this country and North America in general is toward the reduction of water usage.

**Waste** - A final area of concern relates to the requirements to reduce the quantity of the waste that is being discharged. The trend is toward developing a process that is capable of zero discharge. New projects need to look at the beneficial uses of the solid waste, such as concrete production road construction or use of sulfur as the feed stock for process plant operation. The challenge will be to encourage use of byproducts in these markets and to develop additional markets.

## **8.2 REGULATORY ISSUES**

The electric utility industry of today has evolved out of a series of changes in the Public Utilities Holding Company Act (PUHCA). This model was predicated on the management of a number of monopoly generating and distribution utilities that were charged with the requirement to serve, in exchange for the exclusive right to a service territory. This started to change with the passage of the Public Utilities Regulatory Policy Act of 1978. This change has accelerated since the latest enabling legislation, the Energy Policy Act of 1992.

The utility industry has responded to the changing legislative agenda with mixed reactions. In some cases, there is aggressive restructuring of the business designed to anticipate the direction the industry will take. In other cases, utility companies are taking more of a “wait and see” attitude. Today, the utility industry is made up of investor-owned, government-owned, and independent power producers. The final direction to be taken by the industry will not be clear for a number of years pending the interpretation of the new regulations by the industry, the legislatures, the regulators at the federal and state levels, and the courts.

### **8.2.1 Role of Federal Policies**

The Federal Power Act supported self-sufficient, vertically integrated electric utilities, in which generation, transmission, and distribution facilities were owned by a single entity and sold as part

of a bundled service (delivered electric energy) to wholesale and retail customers. Most electric utilities built their own power plants and transmission systems, entered into interconnection and coordination arrangements with neighboring utilities, and entered into long-term contracts to make wholesale requirements sales (bundled sales of generation and transmission) to municipal, cooperative, and other investor-owned utilities (IOUs) connected to each utility's transmission system. Each system covered a limited service area. This structure of separate systems developed primarily because of the cost and technological limitations on the distance over which electricity could be transmitted. Through much of the 1960s, utilities were able to avoid price increases, but still achieve increased profits because of substantial increases in scale economies, technological improvements, and only moderate increases in input prices.

The Public Utilities Regulatory Policy Act (PURPA) of 1978 started a wave of change throughout the electric utility industry. This legislation opened the electrical generating market to independent generators. The most significant was the emergence of the independent power producer (IPP), a non-utility producer of electric power. The wave of non-utility generators has been responsible for a significant number of the new generating assets built since 1985.

In enacting PURPA, Congress recognized that the rising costs and decreasing efficiencies of utility-owned generating facilities were increasing rates to consumers. In particular, Congress sanctioned the development of alternative generation sources designated as "qualifying facilities" (QFs) as a means of reducing the demand for traditional fossil fuels. PURPA required utilities to purchase power from QFs at a price not to exceed the utility's avoided costs and to sell backup power to QFs.

Legislation continuing this fundamental change in the utility industry was the Energy Policy Act of 1992 (EPAct). EPAct introduced a number of changes to the Federal Power Act, PUHCA, and PURPA. These changes address wholesale wheeling and integrated resource planning, and promote energy efficiency. In addition, the EPAct established a new category of non-utility generators, exempt from PUHCA, the Exempt Wholesale Generators (EWGs). The EPAct also expanded the Federal Energy Regulatory Commission's (FERC's) authority to order utilities to provide wheeling service to companies that generate energy for resale.

Regulation changes intended to increase the amount of free-market competition in the electric power industry are beginning. To date, the broadest action is FERC's Order No. 888 Final Rule, issued April 24, 1996, "Promoting Wholesale Competition Through Open Access Non-Discriminatory Transmission Services by Public Utilities; Recovery of Stranded Costs by Public Utilities and Transmitting Utilities." This rule requires all public utilities that own, control, or operate transmission for interstate commerce to have open access non-discriminatory transmission tariffs that contain minimum terms and conditions of service. The rule also permits the recovery of legitimate, prudent, and verifiable stranded costs associated with providing open access and transmission service. The object of this action is to promote competition in the wholesale bulk power market and provide consumers with more efficient, lower cost power. Under this rule competition in the electric utility market has been established. Public utilities have already responded by filing wholesale open access tariffs. It has been estimated by FERC that the potential benefits from this rule will be approximately \$3.8 to \$5.4 billion per year in cost savings.

### **8.2.2 State Regulatory Issues**

The role of the state in the regulatory area is also changing. Changes in the federal law are prompting the states to look at their role as regulators. Some states are already moving to deregulate. Wheeling of power and free access to the distribution grid for EWGs is beginning. Many electric utilities are restructuring in anticipation of changes in their operation. States are addressing issues of integrated resource planning (IRP), wholesale wheeling, rate setting and cost disallowances, and stranded capital.

Essentially, IRP provisions establish ratemaking standards that encourage utilities to use demand side management and efficiency measures to meet their customers' needs. The approach treats supply and demand side resources on an equal basis. IRP will provide utility companies with an incentive to look at efficiency improvements.

Wheeling and free access to the utility distribution grid is at the core of the deregulation issue. The EPAct provides the owners of facilities generating electricity for sale or resale with the means to request FERC to grant transmission access. As a part of the deregulation process, the Act requires that the owners first negotiate for 60 days before a complaint is filed with FERC. In

addition to wholesale wheeling, EPAct encourages the states to look at retail wheeling. It should be noted, the Act prohibits FERC from ordering retail wheeling. The outcome of the wheeling issue as provided by FERC Order No. 888 will significantly set the form of the utility industry.

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